## IN THE CLAIMS

This listing of the claim will replace all prior versions and listings of claim in the present application.

## Listing of Claims

Claims 1-22 (canceled).

23. (currently amended)A public-key cryptographic <u>method</u> <u>implemented in a computer system</u> ~~scheme~~ comprising:

a key generation step of generating a secret-key:

$$\bullet \ x_1, x_2, y_{11}, y_{12}, y_{21}, y_{22}, z \in \mathbb{Z}_q$$

and a public-key:

- $G, G'$ : finite (multiplicative) group $\qquad G \subsetneq G'$
- $q$ : prime number (the order of G)
- $g_1, g_2 \in G$
- $c = g_1^{x_1} g_2^{x_2}, \ d_1 = g_1^{y_{11}} g_2^{y_{12}}, \ d_2 = g_1^{y_{21}} g_2^{y_{22}}, \ h = g_1^{z},$
- $\pi : X_1 \times X_2 \times M \longrightarrow G'$ : one-to-one mapping
- $\pi^{-1} : \mathrm{Im}(\pi) \longrightarrow X_1 \times X_2 \times M$

where the group G is a partial group of the group G', $X_1$ and $X_2$ are an infinite set of positive integers which satisfy:

$$\alpha_1 || \alpha_2 < q \qquad (\forall \alpha_1 \in X_1, \ \forall \alpha_2 \in X_2)$$

where M is a plaintext space;

a ciphertext generation and transmission step of selecting random numbers $\alpha_1 \epsilon X_1$, $\alpha_2 \epsilon X_2$, $r \epsilon Zq$ for a plaintext m (m $\epsilon$ M), calculating:

$$u_1 = g_1^{r}, \quad u_2 = g_2^{r}, \quad e = \pi(\alpha_1, \alpha_2, m)h^{r}, \quad v = g_1^{\alpha_1} c^{r} d_1^{\alpha r} d_2^{mr}$$

where $\alpha = \alpha_1 \ || \ \alpha_2$, and transmitting ($u_1$, $u_2$, e, v) as a ciphertext; and

a ciphertext reception and decipher step of calculating from the

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received ciphertext and by using the secret key, $\alpha'_1$, $\alpha'_2$, m' ($\alpha'_1 \epsilon X_1$, $\alpha'_2 \epsilon X_2$, m'$\epsilon$M) which satisfy:

$$\pi(\alpha'_1, \alpha'_2, m') = e/u_1{}^z$$

and if the following is satisfied:

$$g_1{}^{\alpha'_1} u_1{}^{x_1 + \alpha' y_{11} + m' y_{21}} u_2{}^{x_2 + \alpha' y_{12} + m' y_{22}} = v$$

outputting m' as the deciphered results (where $\alpha' = \alpha'_1 \,\|\, \alpha'_2$), whereas if not satisfied, outputting as the decipher results the effect that the received ciphertext is rejected.

24.　(currently amended)A public-key cryptographic method~~scheme~~ comprising:

a key generation step of generating a secret-key:

- $x_1, x_2, y_{11}, y_{12}, y_{21}, y_{22}, z \in \mathbb{Z}_q$

and a public-key:

- $p, q$ :　prime number (q is a prime factor of p-1)
- $g_1, g_2 \in \mathbb{Z}_p$ : $\operatorname{ord}_p(g_1) = \operatorname{ord}_p(g_2) = q$
- $c = g_1{}^{x_1} g_2{}^{x_2} \bmod p$, $d_1 = g_1{}^{y_{11}} g_2{}^{y_{12}} \bmod p$, $d_2 = g_1{}^{y_{21}} g_2{}^{y_{22}} \bmod p$, $h = g_1{}^z \bmod p$,
- $k_1, k_2, k_3$ :　positive constant 　　($10^{k_1+k_2} < q$, $10^{k_3} < q$, $10^{k_1+k_2+k_3} < p$)

a ciphertext generation and transmission step of selecting random numbers $\alpha = \alpha_1 \,\|\, \alpha_2$ ($|\alpha_1| = k_1$, $|\alpha_2| = k_2$) for a plaintext m ($|m| = k_3$, where $|x|$ is a ~~the~~ number of digits of x), calculating:

$$\tilde{m} = \alpha \| K$$

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selecting a random number $r \varepsilon Zq$, calculating:

$$u_1 = g_1{}^r \bmod p, \quad u_2 = g_2{}^r \bmod p, \quad e = \tilde{m}\, h^r \bmod p, \quad v = g_1{}^{\alpha_1} c^r d_1{}^{\alpha r} d_2{}^{mr} \bmod p$$

and transmitting ($u_1$, $u_2$, e, v) as a ciphertext; and

a ciphertext reception and decipher step of calculating from the received ciphertext and by using the secret key, $\alpha'_1$, $\alpha'_2$, m' ($|\alpha'_1| = k_1$, $|\alpha'_2| = k_2$, $|m'| = k_3$) which satisfy:

$$\alpha'_1 || \alpha'_2 || m' = e / u_1{}^z \bmod p$$

and if the following is satisfied:

$$g_1{}^{\alpha'_1} u_1{}^{x_1 + \alpha' y_{11} + m' y_{21}} u_2{}^{x_2 + \alpha' y_{12} + m' y_{22}} \equiv v \pmod{p}$$

outputting m' as the deciphered results (where $\alpha' = \alpha'_1 \,||\, \alpha'_2$), whereas if not satisfied, outputting as the decipher results the effect that the received ciphertext is rejected.


25.    (currently amended) A public-key cryptographic methodscheme according to claim 123, wherein the public-key is generated by a receiver and is made public.


26.    (currently amended) A public-key cryptographic scheme method according to claim 123, wherein in said ciphertext transmission step, the random numbers $\alpha_1 \varepsilon X_1$, $\alpha_2 \varepsilon X_2$ and $r \varepsilon Zq$ are selected beforehand and the following is calculated and stored beforehand:

$$u_1 = g_1{}^r, \quad u_2 = g_2{}^r, \quad h^r, \quad g_1{}^{\alpha_1} c^r d_1{}^{\alpha r}$$

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27.    (currently amended)A public-key cryptographic methodscheme according to claim 224, wherein in said ciphertext transmission step, the random numbers $\alpha_1$, $\alpha_2$ ($|\alpha_1| = k_1$, $|\alpha_2| = k_2$), and $r \in Zq$ are selected beforehand and the following is calculated and stored beforehand:

$$u_1 = g_1^r \bmod p, \quad u_2 = g_2^r \bmod p, \quad h^r \bmod p, \quad g_1^{\alpha_1} c^r d_1^{\alpha r} \bmod p$$

28.    (currently amended)A cryptographic communication method implemented in a computer system comprising:

a key generation step of generating a secret-key:

- $x_1, x_2, y_{11}, y_{12}, y_{21}, y_{22}, z \in Z_q$

and a public-key:

- $G, G'$ :    finite (multiplicative) group     $G \subseteq G'$
- $q$ :    prime number (the order of G)
- $g_1, g_2 \in G$
- $c = g_1^{x_1} g_2^{x_2}$, $d_1 = g_1^{y_{11}} g_2^{y_{12}}$, $d_2 = g_1^{y_{21}} g_2^{y_{22}}$, $h = g_1^z$,
- $\pi : X_1 \times X_2 \times M \longrightarrow G'$ :    one-to-one mapping
- $\pi^{-1} : \text{Im}(\pi) \longrightarrow X_1 \times X_2 \times M$
- $E$ :    symmetric encipher function

where the group G is a partial group of the group G', $X_1$ and $X_2$ are an infinite set of positive integers which satisfy:

$$\alpha_1 \| \alpha_2 < q \qquad (\forall \alpha_1 \in X_1, \forall \alpha_2 \in X_2)$$

where M is a key space;

a ciphertext generation and transmission step of selecting random

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numbers $\alpha_1 \epsilon X_1$, $\alpha_2 \epsilon X_2$, $r \epsilon Zq$ for key data K (K $\epsilon$ M), calculating:

$$u_1 = g_1{}^r, \quad u_2 = g_2{}^r, \quad e = \pi(\alpha_1, \alpha_2, K)h^r, \quad v = g_1{}^{\alpha_1} c^r d_1{}^{\alpha r} d_2{}^{Kr}$$

where $\alpha = \alpha_1 \| \alpha_2$, generating a ciphertext C of transmission data m by:

$$C = E_K(m)$$

by using a (symmetric cryptographic function E and key data K, and transmitting ($u_1$, $u_2$, e, v, C) as the ciphertext; and

a ciphertext reception and decipher step of calculating from the received ciphertext and by using the secret key, $\alpha'_1$, $\alpha'_2$, K' ($\alpha'_1 \epsilon X_1$, $\alpha'_2 \epsilon X_2$, K' $\epsilon$ M) which satisfy:

$$\pi(\alpha'_1 \| \alpha'_2 \| K') = e/u_1{}^z$$

and if the following is satisfied:

$$g_1{}^{\alpha'_1} u_1{}^{x_1 + \alpha' y_{11} + K' y_{21}} u_2{}^{x_2 + \alpha' y_{12} + K' y_{22}} = v$$

where $\alpha' = \alpha'_1 \| \alpha'_2$

executing a decipher process by:

$$m = D_{K'}(C)$$

outputting deciphered results, whereas if not satisfied, outputting as the decipher results the effect that the received ciphertext is rejected.

29. (currently amended)A cryptographic communication method according to claim ~~6~~28, wherein the ciphertext C is generated by:

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$$C = E_K(f(\alpha_1, \alpha_2)\|m)$$

by using a symmetric cryptographic function E, the key data K and a publicized proper function f, it is checked whether the following is satisfied:

$$g_1{}^{\alpha'_1 u_1{}^{x_1 + \alpha' y_{11} + K' y_{21}} u_2{}^{x_2 + \alpha' y_{12} + K' y_{22}}} = v,$$
$$f(\alpha'_1, \alpha'_2) = [D_{K'}(C)]^k$$

where f outputs a value of k bits and $[x]^k$ indicates the upper k bits of x, and if the check passes, a decipher process is executed by:

$$m = [D_{K'}(C)]^{-k}$$

where $[x]^{-k}$ indicates a bit train with the upper k bits of x being removed.

30.      (currently amended)   A cryptographic communication method _implemented in a computer system_ comprising:

a key generation step of generating a secret-key:

- $x_1, x_2, y_{11}, y_{12}, y_{21}, y_{22}, z \in \mathbb{Z}_q$

and a public-key:

- $p, q$ :   prime number (q is a prime factor of p-1)
- $g_1, g_2 \in \mathbb{Z}_p$ : $\mathrm{ord}_p(g_1) = \mathrm{ord}_p(g_2) = q$
- $c = g_1{}^{x_1} g_2{}^{x_2} \bmod p$, $d_1 = g_1{}^{y_{11}} g_2{}^{y_{12}} \bmod p$, $d_2 = g_1{}^{y_{21}} g_2{}^{y_{22}} \bmod p$, $h = g_1{}^z \bmod p$,
- $k_1, k_2, k_3$ :   positive constant      ($10^{k_1+k_2} < q$, $10^{k_3} < q$, $10^{k_1+k_2+k_3} < p$)
- $E$ :   symmetric encipher function

a ciphertext generation and transmission step of selecting random

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numbers $\alpha = \alpha_1 \| \alpha_2$ ($|\alpha_1| = k_1$, $|\alpha_2| = k_2$) for key data K ($|K| = k_3$, where $|x|$ is a the-number of digits of x), calculating:

$$\tilde{m} = \alpha \| K$$

selecting a random number $r \epsilon Zq$, calculating:

$$u_1 = g_1{}^r \bmod p, \quad u_2 = g_2{}^r \bmod p, \quad e = \tilde{m}\, h^r \bmod p, \quad v = g_1{}^{\alpha_1} c^r d_1{}^{\alpha r} d_2{}^{Kr} \bmod p$$

and generating a ciphertext C of transmission data by:

$$C = E_K(m)$$

by using a (symmetric) cryptographic function E and the key data K, and transmitting ($u_1$, $u_2$, e, v, C) as the ciphertext; and

a ciphertext reception and decipher step of calculating from the received ciphertext and by using the secret key, $\alpha'_1$, $\alpha'_2$, K' ($|\alpha'_1| = k_1$, $|\alpha'_2| = k_2$, $|K'| = k_3$) which satisfy:

$$\alpha'_1 \| \alpha'_2 \| K' = e/u_1{}^z \bmod p$$

and if the following is satisfied:

$$g_1{}^{\alpha'_1} u_1{}^{x_1 + \alpha' y_{11} + K' y_{21}} u_2{}^{x_2 + \alpha' y_{12} + K' y_{22}} \equiv v \quad (\bmod\ p)$$

where $\alpha' = \alpha'_1 \| \alpha'_2$,

executing a decipher process by:

$$m = D_{K'}(C)$$

outputting deciphered results, whereas if not satisfied, outputting as the

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decipher results the effect that the received ciphertext is rejected.


31. (currently amended)   A   cryptographic   communication   method
according to claim ~~8~~30, wherein the ciphertext C is generated by:


$$C = E_K(f(\alpha_1, \alpha_2)\|m)$$


by using a symmetric cryptographic function E, the key data K and a
publicized proper function f, it is checked whether the following is satisfied:


$$g_1^{\alpha_1'} u_1^{x_1 + \alpha' y_{11} + K' y_{21}} u_2^{x_2 + \alpha' y_{12} + K' y_{22}} \equiv v \quad (\bmod\ p),$$
$$f(\alpha_1', \alpha_2') = [D_{K'}(C)]^k$$


where f outputs a value of k bits and $[x]^k$ indicates the upper k bits of x, and if
the check passes, a decipher process is executed by:


$$m = [D_{K'}(C)]^{-k}$$


where $[x]^{-k}$ indicates a bit train with the upper k bits of x being removed.


32.    (currently amended)A   cryptographic   communication   method
according to claim ~~6~~28, wherein the public-key is generated by a receiver and
is made public.


33.    (currently amended)A   cryptographic   communication   method
according to claim ~~6~~28, wherein in said ciphertext transmission step, the
random numbers $\alpha_1$, $\alpha_2$ ($\alpha_1 \epsilon X_1$, $\alpha_2 \epsilon X_2$) and $r \epsilon Zq$ are selected beforehand and
the following is calculated and stored beforehand:


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$$u_1 = g_1{}^r, \quad u_2 = g_2{}^r, \quad h^r, \quad g_1{}^{\alpha_1}c^r d_1{}^{\alpha r}$$

34. (currently amended)A cryptographic communication method according to claim 6̶28, wherein in said ciphertext transmission step, the random numbers $\alpha_1$, $\alpha_2$ ($|\alpha_1| = k_1$, $|\alpha_2| = k_2$) and $r \in Zq$ are selected beforehand and the following is calculated and stored beforehand:

$$u_1 = g_1{}^r \bmod p, \quad u_2 = g_2{}^r \bmod p, \quad h^r \bmod p, \quad g_1{}^{\alpha_1}c^r d_1{}^{\alpha r} \bmod p$$

35. (currently amended)A cryptographic communication method implemented in a computer system comprising:

a key generation step of generating a secret-key:

- $x_1, x_2, y_1, y_2, z \in \mathbb{Z}_q$

and a public-key:

- $G, G'$ : finite (multiplicative) group $\qquad G \subseteq G'$
- $q$ : prime number (the order of G)
- $g_1, g_2 \in G$
- $c = g_1{}^{x_1}g_2{}^{x_2}$, $d = g_1{}^{y_1}g_2{}^{y_2}$, $h = g_1{}^z$,
- $\pi : X_1 \times X_2 \times M \longrightarrow \mathrm{Dom}(E)$ : one-to-one mapping (Dom(E) is the domain of the function E)
- $\pi^{-1} : \mathrm{Im}(\pi) \longrightarrow X_1 \times X_2 \times M$
- $H$ : hash function
- $E$ : symmetric encipher function

where the group G is a partial group of the group G', $X_1$ and $X_2$ are an infinite set of positive integers which satisfy:

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$$\alpha_1 || \alpha_2 < q \qquad (\forall \alpha_1 \in X_1, \ \forall \alpha_2 \in X_2)$$

a ciphertext generation and transmission step of selecting random numbers $\alpha_1 \in X_1$, $\alpha_2 \in X_2$, $r \in Zq$, calculating:

$$u_1 = g_1{}^r, \quad u_2 = g_2{}^r, \quad v = g_1{}^{\alpha_1} c^r d^{\alpha r}, \quad K = H(h^r)$$

where $\alpha = \alpha_1 \,||\, \alpha_2$, generating a ciphertext C of transmission data m by

$$C = E_K(\pi(\alpha_1, \alpha_2, m))$$

by using a (symmetric) cryptographic function E; and transmitting ($u_1$, $u_2$, v, C) as the ciphertext; and

a ciphertext reception and decipher step of calculating:

$$K' = H(u_1{}^z)$$

by using the secret key, calculating from the received ciphertext, $\alpha'_1$, $\alpha'_2$ (where $\alpha'_1 \in X_1$ $\alpha'_2 \in X_2$) which satisfy:

$$\pi(\alpha'_1, \alpha'_2, m') = D_{K'}(C)$$

if the following is satisfied:

$$g_1{}^{\alpha'_1} u_1{}^{x_1 + \alpha' y_1} u_2{}^{x_2 + \alpha' y_2} = v,$$

where $\alpha' = \alpha'_1 \,||\, \alpha'_2$

outputting m' as the deciphered results, whereas if not satisfied, outputting as the decipher results the effect that the received ciphertext is rejected.

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36.    (currently amended)A  cryptographic  communication  method

implemented in a computer system comprising:

a key generation step of generating a secret-key:

- $x_1, x_2, y_1, y_2, z \in \mathbb{Z}_q$

and a public-key:

- $p, q$ :    prime number (q is a prime factor of p-1)
- $g_1, g_2 \in \mathbb{Z}_p$ : $\mathrm{ord}_p(g_1) = \mathrm{ord}_p(g_2) = q$
- $c = g_1{}^{x_1} g_2{}^{x_2} \bmod p$, $d = g_1{}^{y_1} g_2{}^{y_2} \bmod p$, $h = g_1{}^{z} \bmod p$,
- $k_1, k_2, k_3$ :    positive constant     $(10^{k_1+k_2} < q,\ 10^{k_3} < q,\ 10^{k_1+k_2+k_3} < p)$
- $H$ :    hash function
- $E$ :    symmetric encipher function (the domain of E is all positive integers)

a  ciphertext  generation  and  transmission  step  of  selecting  random

numbers $\alpha = \alpha_1 \| \alpha_2$ ($|\alpha_1| = k_1$, $|\alpha_2| = k_2$, where ($|x|$ is the number of digits of x),

selecting a random number $r_\epsilon Zq$, calculating:

$$u_1 = g_1{}^{r} \bmod p, \quad u_2 = g_2{}^{r} \bmod p, \quad v = g_1{}^{\alpha_1} c^{r} d^{\alpha r} \bmod p, \quad K = H(h^{r} \bmod p)$$

transmitting  the  ciphertext  ($u_1$,  $u_2$,  v,  C);  generating  a  ciphertext  C  of

transmission data m by:

$$C = E_K(\alpha_1 \| \alpha_2 \| m)$$

by using a (symmetric) cryptographic function, and transmitting ($u_1$, $u_2$, v, C)

as the ciphertext;

a ciphertext reception and decipher step of calculating:

$$K' = H(u_1{}^{z} \bmod p)$$

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by using the secret key, calculating from the received ciphertext, $\alpha'_1$, $\alpha'_2$ ($|\alpha'_1|$ = $k_1$, $|\alpha'_2|$ = $k_2$) which satisfy:

$$\alpha'_1 \| \alpha'_2 \| m' = D_{K'}(C)$$

and if the following is satisfied:

$$g_1{}^{\alpha'_i} u_1{}^{x_1 + \alpha' y_1} u_2{}^{x_2 + \alpha' y_2} \equiv v \quad (\text{mod } p)$$

outputting m' as the deciphered results (where $\alpha' = \alpha'_1 \| \alpha'_2$), whereas if not satisfied, outputting as the decipher results the effect that the received ciphertext is rejected.

37.    (currently amended)A cryptographic communication method according to claim ~~13~~35, wherein the public-key is generated by a receiver and is made public.

38.    (currently amended)A cryptographic communication method according to claim ~~13~~35, wherein in said ciphertext transmission step, the random numbers $\alpha_1$, $\alpha_2$ ($\alpha_1 \in X_1$, $\alpha_2 \in X_2$) and $r \in Zq$ are selected beforehand and the $u_1$, $u_2$, e and v are calculated and stored beforehand.

39.    (currently amended) A cryptographic communication method according to claim ~~14~~36, wherein in said ciphertext transmission step, the random numbers $\alpha_1$, $\alpha_2$ ($|\alpha_1|$ = $k_1$, $|\alpha_2|$ = $k_2$), and $r \in Zq$ are selected beforehand and the $u_1$, $u_2$, e and v are calculated and stored beforehand.

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40.   (currently amended)A  cryptographic  communication  method implemented in a computer system comprising:

a key generation step of generating a secret-key:

- $x_1, x_2, y_1, y_2 \in Z_q$
- $sk$ :  (asymmetric cryptography) decipher key

and a public-key:

- $G$ :  finite (multiplicative) group
- $q$ :  prime number (the order of G)
- $g_1, g_2 \in G$
- $c = g_1{}^{x_1} g_2{}^{x_2}$, $d = g_1{}^{y_1} g_2{}^{y_2}$,
- $\pi : X_1 \times X_2 \times M \longrightarrow \mathrm{Dom}(E)$ :  one-to-one mapping (Dom(E) is the domain of the function E)
- $\pi^{-1} : \mathrm{Im}(\pi) \longrightarrow X_1 \times X_2 \times M$
- $E_{pk}(\cdot)$ :  (asymmetric cryptography) encipher function

where the group G is a partial group of the group G', $X_1$ and $X_2$ are an infinite set of positive integers which satisfy:

$$\alpha_1 || \alpha_2 < q \qquad (\forall \alpha_1 \in X_1, \ \forall \alpha_2 \in X_2)$$

where M is a plaintext space;

a ciphertext generation and transmission step of selecting random numbers $\alpha_1 \in X_1$, $\alpha_2 \in X_2$, $r \in Zq$, calculating:

$$u_1 = g_1{}^r, \quad u_2 = g_2{}^r, \quad v = g_1{}^{\alpha_1} c^r d^{\alpha r}$$

where $\alpha = \alpha_1 || \alpha_2$, generating a ciphertext C of transmission data m by:

$$e = E_{pk}(\pi(\alpha_1, \alpha_2, m))$$

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by using an (asymmetric) cryptographic function $E_{pk}$, and transmitting ($u_1$, $u_2$, e, v) as the ciphertext; and

a ciphertext reception and decipher step of calculating from the received ciphertext and by using the secret key, $\alpha'_1$, $\alpha'_2$, m' ($\alpha'_1 \epsilon X_1$, $\alpha'_2 \epsilon X_2$, $m' \epsilon M$) which satisfy:

$$\pi(\alpha'_1, \alpha'_2, m') = D_{sk}(e)$$

and if the following is satisfied:

$$g_1^{\alpha'_1} u_1^{x_1+\alpha'y_1} u_2^{x_2+\alpha'y_2} = v$$

where:

$$\alpha' = \alpha'_1 \| \alpha'_2$$

outputting m' as the deciphered results, whereas if not satisfied, outputting as the decipher results the effect that the received ciphertext is rejected.

**41.** (currently amended)A cryptographic communication method implemented in a computer system comprising:

a key generation step of generating a secret-key:

- $x_1, x_2, y_1, y_2 \in \mathbb{Z}_q$
- $sk$ : (asymmetric cryptography) decipher key

and a public-key:

- $p, q$ : prime number (q is a prime factor of p-1)
- $g_1, g_2 \in \mathbb{Z}_p$ : $\text{ord}_p(g_1) = \text{ord}_p(g_2) = q$
- $c = g_1^{x_1} g_2^{x_2} \bmod p$, $d = g_1^{y_1} g_2^{y_2} \bmod p$,
- $k_1, k_2$ : positive constant $(10^{k_1+k_2} < q)$
- $E_{pk}(\cdot)$ : (asymmetric cryptography) encipher function (the domain is all positive integers)

a ciphertext generation and transmission step of selecting random numbers $\alpha = \alpha_1 \parallel \alpha_2$ ($|\alpha_1| = k_1$, $|\alpha_2| = k_2$, where $|x|$ is the number of digits of $x$), selecting a random number $r_\epsilon Zq$, calculating:

$$u_1 = g_1{}^r \bmod p, \quad u_2 = g_2{}^r \bmod p, \quad v = g_1{}^{\alpha_1} c^r d^{\alpha r} \bmod p$$

generating a ciphertext C of transmission data m (positive integer) by:

$$e = E_{pk}(\alpha_1 \parallel \alpha_2 \parallel m)$$

by using the secret key, and transmitting ($u_1$, $u_2$, $e$, $v$) as the ciphertext; and

a ciphertext reception and decipher step of calculating from the received ciphertext and by using the secret key, $\alpha'_1$, $\alpha'_2$, m' ($|\alpha'_1| = k_1$, $|\alpha'_2| = k_2$, m' is a positive integer) which satisfy:

$$\alpha'_1 \parallel \alpha'_2 \parallel m' = D_{sk}(e)$$

and if the following is satisfied:

$$g_1{}^{\alpha'_1} u_1{}^{x_1 + \alpha' y_1} u_2{}^{x_2 + \alpha' y_2} \equiv v \quad (\bmod\ p),$$

where:

$$\alpha' = \alpha'_1 \parallel \alpha'_2$$

outputting m' as the deciphered results, whereas if not satisfied, outputting as the decipher results the effect that the received ciphertext is rejected.

42.    (currently amended)A  cryptographic  communication  method

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according to claim ~~18~~40, wherein the public-key is generated by a receiver and is made public.

43.    (currently amended)A cryptographic communication method according to claim ~~18~~40, wherein in said ciphertext transmission step, the random numbers $\alpha_1$, $\alpha_2$ ($\alpha_1 \epsilon X_1$, $\alpha_2 \epsilon X_2$) and $r \epsilon Z q$ are selected beforehand and the $u_1$, $u_2$ and $v$ are calculated and stored beforehand.

44.    (currently amended)A cryptographic communication method according to claim ~~19~~41, wherein in said ciphertext transmission step, the random numbers $\alpha_1$, $\alpha_2$ ($|\alpha_1| = k_1$; $|\alpha_2| = k_2$), and $r \epsilon Z q$ are selected beforehand and the $u_1$, $u_2$ and $v$ are calculated and stored beforehand.